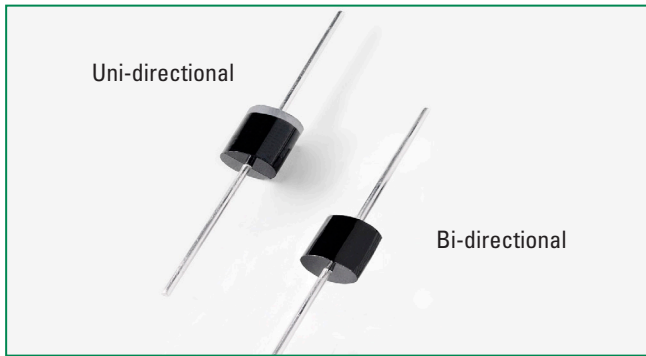


15KPA-HR Series



Agency Approvals

| AGENCY | AGENCY FILE NUMBER |
|--------|--------------------|
| | E230531 |

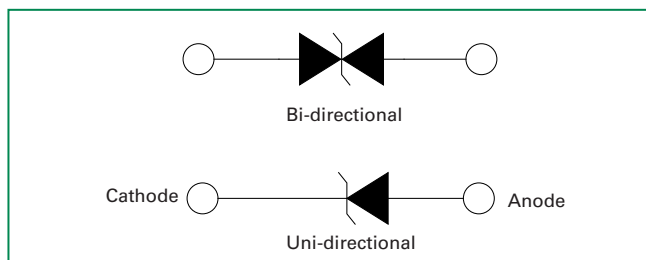
Maximum Ratings and Thermal Characteristics (T_A = 25°C unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|--|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation by 10/1000µs Test Waveform (Fig.2) (Note 1) | P _{PPM} | 15000 | W |
| Steady State Power Dissipation on Infinite Heat Sink at T _L = 75°C (Fig. 6) | P _D | 8.0 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave Unidirectional Only (Note 2) | I _{FSM} | 400 | A |
| Operating Junction and Storage Temperature Range | T _J , T _{STG} | -55 to 175 | °C |
| Typical Thermal Resistance Junction to Lead | R _{θJL} | 8.0 | °C/W |
| Typical Thermal Resistance Junction to Ambient | R _{θJA} | 40 | °C/W |

Notes:

1. Non-repetitive current pulse, per Fig. 4 and derated above T_J (initial) = 25°C per Fig. 3.
2. Measured on 8.3ms single half sine wave or equivalent square wave, duty cycle=4 per minute maximum.

Functional Diagram



Descriptions

The 15KPA-HR High Reliability Series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.


Features

- 15000W peak pulse capability at 10/1000µs waveform, repetition rate (duty cycles):0.01%
- Glass passivated chip junction in P600 package
- Fast response time: typically less than 1.0ps from 0 Volts to BV min
- Excellent clamping capability
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- IEC-61000-4-2 ESD 30kV(Air), 30kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2
- EFT protection of data lines in accordance with IEC 61000-4-4
- Low incremental surge resistance
- Typical I_R less than 2µA when V_{BR min}>36V
- High temperature soldering guaranteed: 260C/10 seconds / 0.375" (9.5mm) lead length, 5 lbs., (2.3kg) tension
- V_{BR} @ T_J = V_{BR} @ 25°C × (1 + α T × (T_J - 25)) (α T: Temperature Coefficient, typical value is 0.1%)
- Plastic package is flammability rated V-0 per Underwriters Laboratories
- Lead-free matte tin plated package
- Halogen free and RoHS compliant
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/ JEDEC J-STD-609A.01)

Applications

TVS devices are ideal for the protection of I/O interfaces, V_{CC} bus and other vulnerable circuits used in telecom, computer, industrial and consumer electronic applications.

Electrical Characteristics ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

| Part Number (Uni) | Part Number (Bi) | Reverse Stand off Voltage V_R (Volts) | Breakdown Voltage V_{BR} (Volts) @ I_T | | Test Current I_T (mA) | Maximum Peak Pulse Current I_{PP} (A) | Maximum Reverse Leakage I_R @ V_R (μA) | Maximum Clamping Voltage V_C @ I_{PP} (V) | Agency Approval  |
|-------------------|------------------|---|--|-------|-------------------------|---|---|---|---|
| | | | MIN | MAX | | | | | |
| 15KPA17A-HR | 15KPA17CA-HR | 17 | 18.99 | 20.79 | 50 | 515.4 | 5000 | 29.3 | X |
| 15KPA18A-HR | 15KPA18CA-HR | 18 | 20.11 | 22.01 | 50 | 488.7 | 5000 | 30.9 | X |
| 15KPA20A-HR | 15KPA20CA-HR | 20 | 22.34 | 24.46 | 20 | 440.2 | 1500 | 34.3 | X |
| 15KPA22A-HR | 15KPA22CA-HR | 22 | 24.57 | 26.91 | 10 | 407.0 | 500 | 37.1 | X |
| 15KPA24A-HR | 15KPA24CA-HR | 24 | 26.81 | 29.35 | 5 | 371.0 | 150 | 40.7 | X |
| 15KPA26A-HR | 15KPA26CA-HR | 26 | 29.04 | 31.80 | 5 | 343.2 | 50 | 44.0 | X |
| 15KPA28A-HR | 15KPA28CA-HR | 28 | 31.28 | 34.24 | 5 | 317.9 | 25 | 47.5 | X |
| 15KPA30A-HR | 15KPA30CA-HR | 30 | 33.51 | 36.7 | 5 | 297.8 | 15 | 50.7 | X |
| 15KPA33A-HR | 15KPA33CA-HR | 33 | 36.9 | 40.4 | 5 | 276.1 | 2 | 54.7 | X |
| 15KPA36A-HR | 15KPA36CA-HR | 36 | 40.2 | 44.0 | 5 | 252.5 | 2 | 59.8 | X |
| 15KPA40A-HR | 15KPA40CA-HR | 40 | 44.7 | 48.9 | 5 | 229.5 | 2 | 65.8 | X |
| 15KPA43A-HR | 15KPA43CA-HR | 43 | 48.0 | 52.6 | 5 | 216.3 | 2 | 69.8 | X |
| 15KPA45A-HR | 15KPA45CA-HR | 45 | 50.3 | 55.0 | 5 | 207.4 | 2 | 72.8 | X |
| 15KPA48A-HR | 15KPA48CA-HR | 48 | 53.6 | 58.7 | 5 | 194.3 | 2 | 77.7 | X |
| 15KPA51A-HR | 15KPA51CA-HR | 51 | 57.0 | 62.4 | 5 | 182.1 | 2 | 82.9 | X |
| 15KPA54A-HR | 15KPA54CA-HR | 54 | 60.3 | 66.0 | 5 | 172.2 | 2 | 87.7 | X |
| 15KPA58A-HR | 15KPA58CA-HR | 58 | 64.8 | 70.9 | 5 | 161.0 | 2 | 93.8 | X |
| 15KPA60A-HR | 15KPA60CA-HR | 60 | 67.0 | 73.4 | 5 | 155.0 | 2 | 97.4 | X |
| 15KPA64A-HR | 15KPA64CA-HR | 64 | 71.5 | 78.3 | 5 | 144.9 | 2 | 104.2 | X |
| 15KPA70A-HR | 15KPA70CA-HR | 70 | 78.2 | 85.6 | 5 | 132.9 | 2 | 113.6 | X |
| 15KPA75A-HR | 15KPA75CA-HR | 75 | 83.8 | 91.7 | 5 | 123.8 | 2 | 122.0 | X |
| 15KPA78A-HR | 15KPA78CA-HR | 78 | 87.1 | 95.4 | 5 | 119.7 | 2 | 126.1 | X |
| 15KPA85A-HR | 15KPA85CA-HR | 85 | 94.9 | 104.0 | 5 | 109.7 | 2 | 137.6 | X |
| 15KPA90A-HR | 15KPA90CA-HR | 90 | 100.5 | 110.1 | 5 | 103.7 | 2 | 145.6 | X |
| 15KPA100A-HR | 15KPA100CA-HR | 100 | 111.7 | 122.3 | 5 | 93.6 | 2 | 161.3 | X |
| 15KPA110A-HR | 15KPA110CA-HR | 110 | 122.9 | 134.5 | 5 | 84.5 | 2 | 178.6 | X |
| 15KPA120A-HR | 15KPA120CA-HR | 120 | 134.0 | 146.8 | 5 | 78.5 | 2 | 192.3 | X |
| 15KPA130A-HR | 15KPA130CA-HR | 130 | 145.2 | 159.0 | 5 | 72.5 | 2 | 208.3 | X |
| 15KPA150A-HR | 15KPA150CA-HR | 150 | 167.6 | 183.5 | 5 | 62.4 | 2 | 241.9 | X |
| 15KPA160A-HR | 15KPA160CA-HR | 160 | 178.7 | 195.7 | 5 | 58.4 | 2 | 258.6 | X |
| 15KPA170A-HR | 15KPA170CA-HR | 170 | 189.9 | 207.9 | 5 | 55.4 | 2 | 272.7 | X |
| 15KPA180A-HR | 15KPA180CA-HR | 180 | 201.1 | 220.1 | 5 | 52.3 | 2 | 288.5 | X |
| 15KPA200A-HR | 15KPA200CA-HR | 200 | 223.4 | 244.6 | 5 | 47.3 | 2 | 319.1 | X |
| 15KPA220A-HR | 15KPA220CA-HR | 220 | 245.7 | 269.1 | 5 | 42.4 | 2 | 356.0 | X |
| 15KPA240A-HR | 15KPA240CA-HR | 240 | 268.1 | 293.5 | 5 | 39.3 | 2 | 384.6 | X |
| 15KPA260A-HR | 15KPA260CA-HR | 260 | 290.4 | 318.0 | 5 | 36.2 | 2 | 416.7 | X |
| 15KPA280A-HR | 15KPA280CA-HR | 280 | 312.8 | 342.4 | 5 | 33.2 | 2 | 454.5 | X |

Note:

- For bidirectional type having V_R of 30 volts and less, the I_R limit is double.
- Each lot of parts will pass group B test requirement.

Screen Process

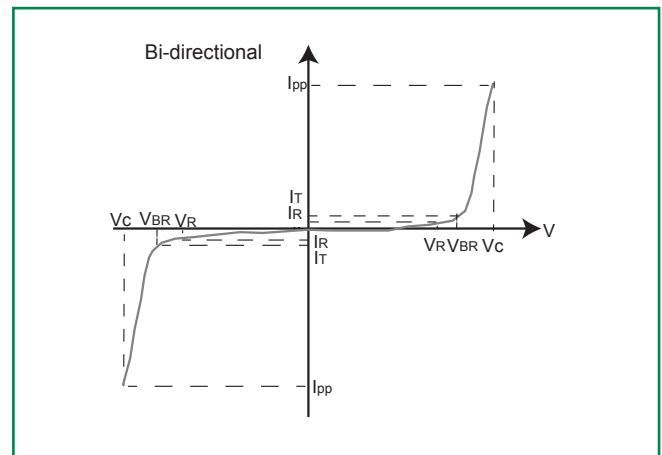
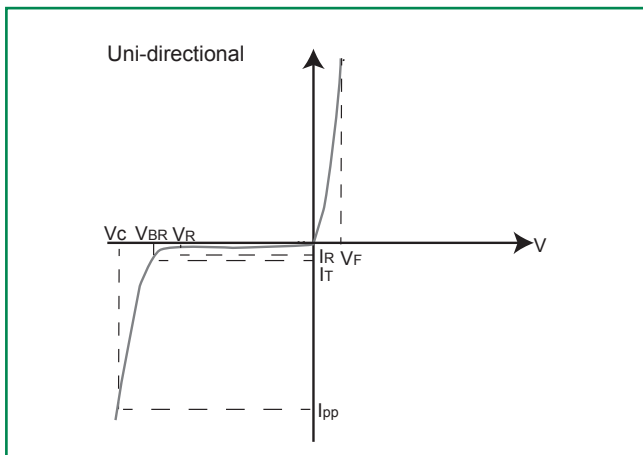
| | |
|--|-----------------------------------|
| 100% Vision Inspection | MIL-STD-750 method 2074 |
| 100% High Temperature Storage Life (168hrs,175°C) | MIL-STD-750 method 1031 |
| 100% Temperature Cycle Test (-55 to150°C, 20 cycles, dwell time 15 min) | MIL-STD-750 method 1051 |
| 100% Surge Test (2x) | MIL-STD-750 method 4066 |
| 100% HTRB 150°C Bias=VR(80% breakdown voltage, 96hrs, and each direction at 96 hrs for Bi-directional products) | MIL-STD-750 method 1038 |
| Final Electrical Test(100% 3 sigma limit, 100% dynamic test and PAT limit) | MIL-STD-750 method 4016.4021.4011 |

Note: Up-screen program can be specified by customer's request via contacting Littelfuse service

Group B Test Requirement

| Screen | Method | Condition | Requirement |
|------------------|-------------------------------------|---|--|
| Surge test | 10/1000 μ s Peak Pluse Waveform | Maximum clamping Voltage (V_c) @ Peak Plus Current (I_{pp}) | Sample Size 45 perform 10x Accept 0 failures |
| Burn - In (HTRB) | MIL-STD-750, Method 1038.5 | Applied voltage 100% V_R @150°C | Sample size 45 340 hours (680 hours for bi-direction products, each direction 340 hours) Accept 0 failures |
| Electrical test | -- | I_R @ V_R , $V_{(BR)}$ @ I_T | Sample size 45 Accept 0 failures |

I-V Curve Characteristics



- P_{PPM} Peak Pulse Power Dissipation** – Max power dissipation
- V_R Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- V_{BR} Breakdown Voltage** – Maximum voltage that flows though the TVS at a specified test current (I_r)
- V_c Clamping Voltage** – Peak voltage measured across the TVS at a specified I_{ppm} (peak impulse current)
- I_r Reverse Leakage Current** – Current measured at V_R
- V_f Forward Voltage Drop for Uni-directional**

Ratings and Characteristic Curves ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

Figure 1 - TVS Transients Clamping Waveform

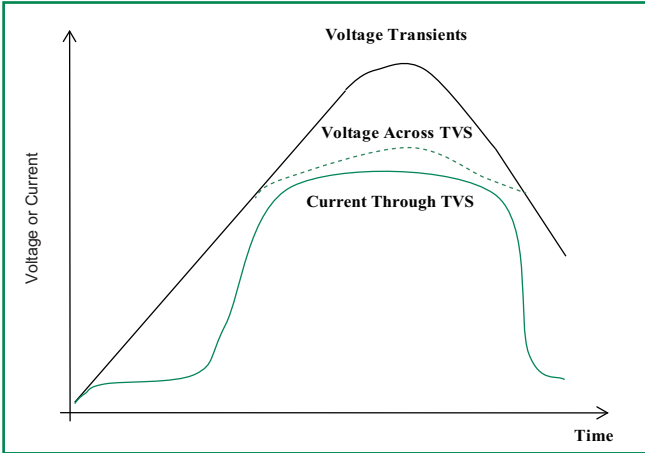


Figure 2 - Peak Pulse Power Rating Curve

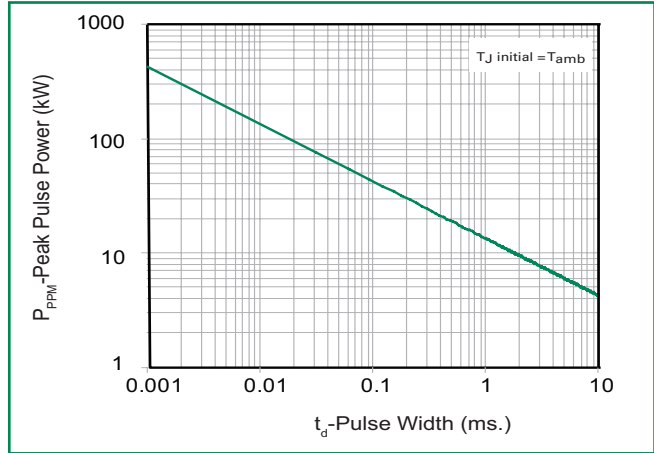


Figure 3 - Peak Pulse Power Derating Curve

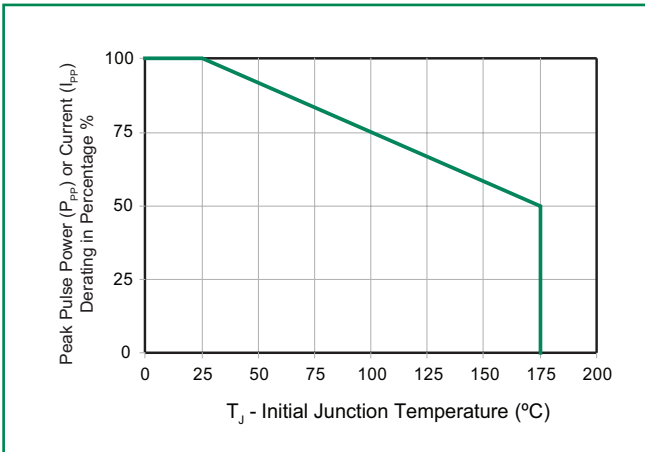


Figure 4 - Test Pulse Waveform

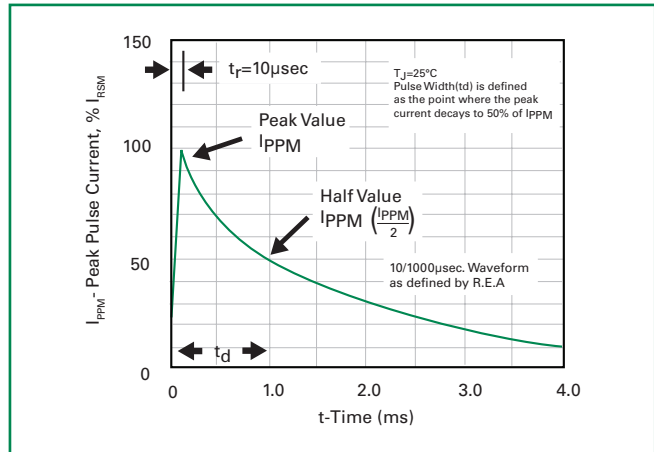


Figure 5 - Typical Junction Capacitance

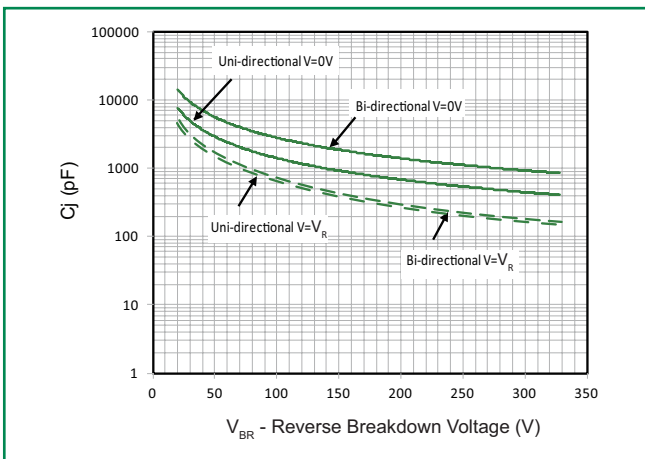


Figure 6 - Typical Transient Thermal Impedance

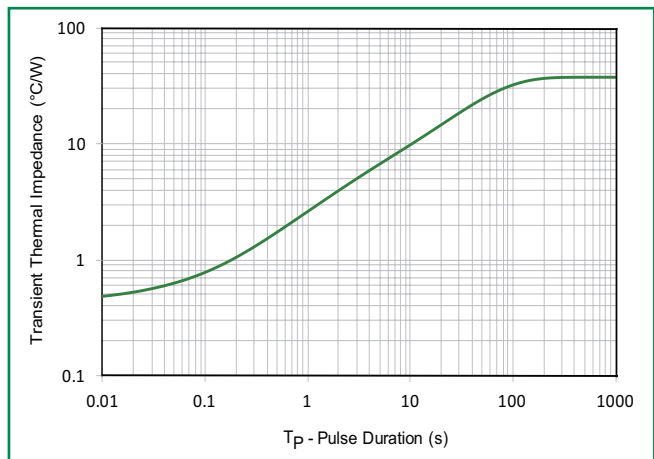


Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only

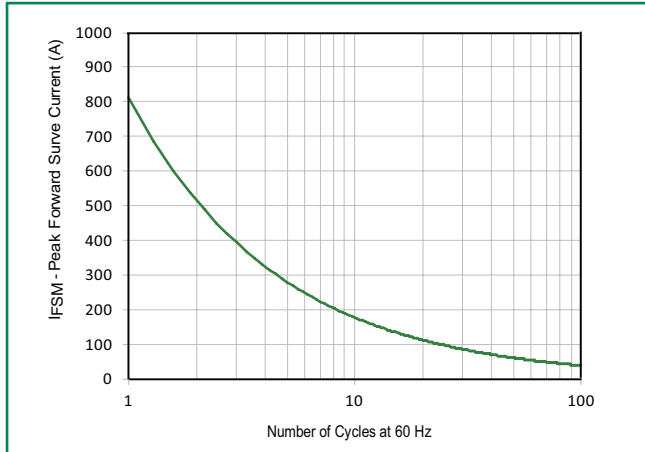
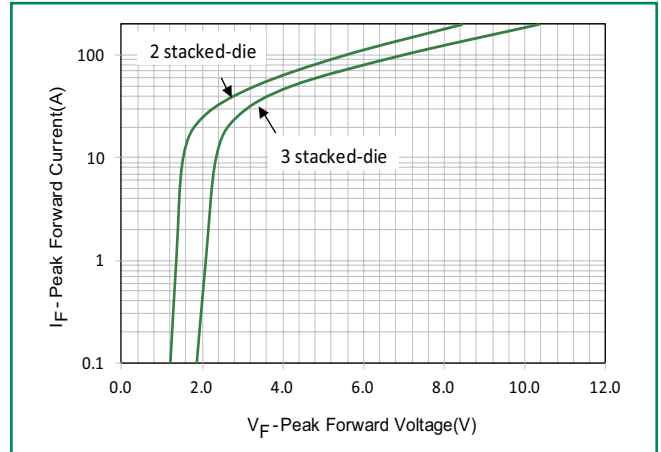


Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)



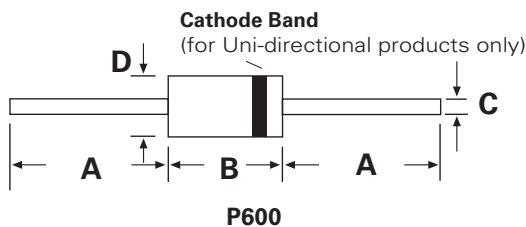
Physical Specifications

| | |
|-----------------|--|
| Weight | 0.07oz., 2.5g |
| Case | P600 molded plastic body over passivated junction. |
| Polarity | Color band denotes the cathode except Bipolar. |
| Terminal | Matte Tin axial leads, solderable per JESD22-B102. |

Environmental Specifications

| | |
|----------------------------|-------------|
| High Temp. Storage | JESD22-A103 |
| HTRB | JESD22-A108 |
| Temperature Cycling | JESD22-A104 |
| H3TRB | JESD22-A101 |
| RSH | JESD22-B106 |

Dimensions

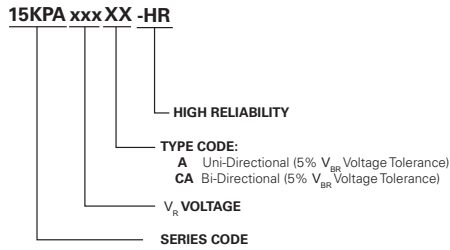


| Dimensions | Inches | | Millimeters | |
|------------|--------|-------|-------------|------|
| | Min | Max | Min | Max |
| A | 1.000 | - | 25.40 | - |
| B | 0.340 | 0.360 | 8.60 | 9.10 |
| C | 0.048 | 0.052 | 1.22 | 1.32 |
| D | 0.340 | 0.360 | 8.60 | 9.10 |

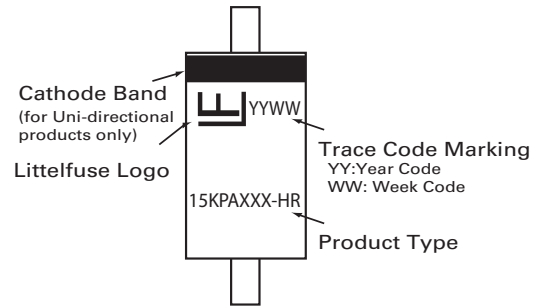
Packing Options

| Part Number | Component Package | Quantity | Packaging Option | Packaging Specification |
|---------------|-------------------|----------|------------------|-------------------------|
| 15KPAxxxXX-HR | P600 | 800 | Tape & Reel | EIA STD RS-296 |

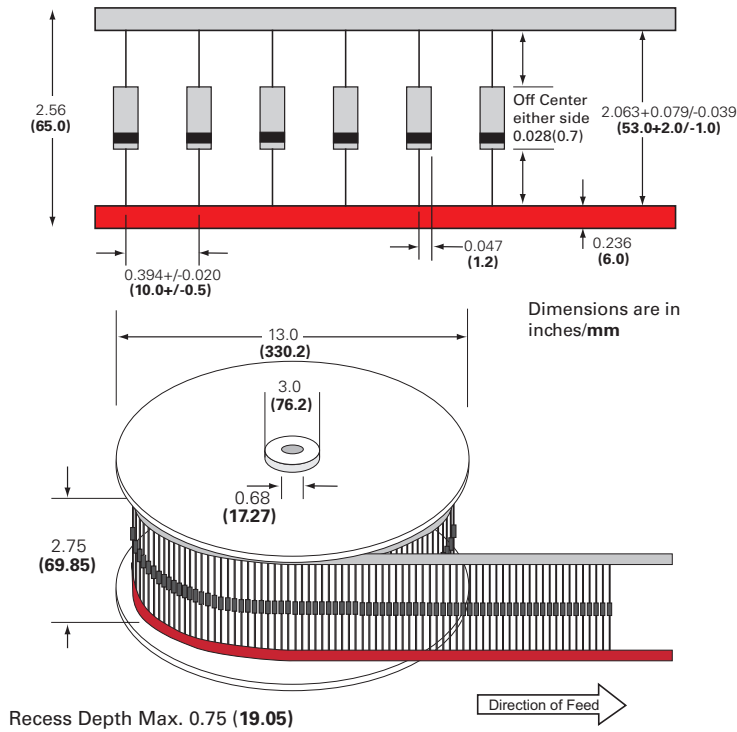
Part Numbering System



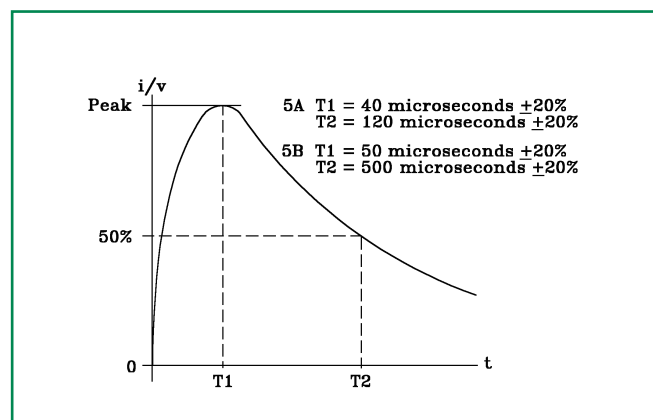
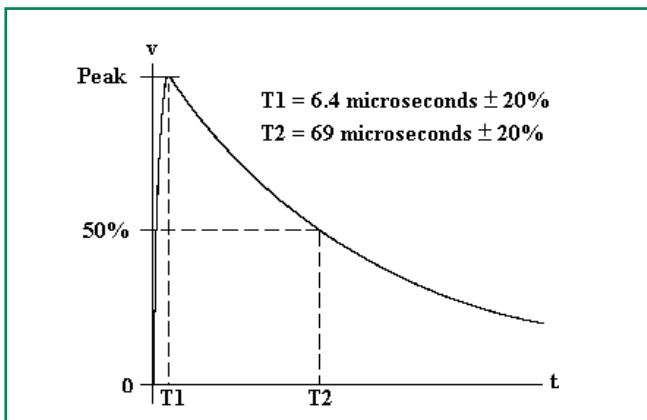
Part Marking System



Tape and Reel Specification



RTCA/DO-160G Wave 4 and Wave 5



Pin Injection Protection Per RTCA/DO-160G

| Part Number (Uni) | Part Number (Bi) | 25C | | | | | 70C | | | | | 120C | | | | |
|-------------------|------------------|-------------------|------|------|--------------------|------|-------------------|------|------|--------------------|------|-------------------|------|------|--------------------|------|
| | | Wave 4 (6.4/69us) | | | Wave 5a (40/120us) | | Wave 4 (6.4/69us) | | | Wave 5a (40/120us) | | Wave 4 (6.4/69us) | | | Wave 5a (40/120us) | |
| | | L3 | L4 | L5 | L3 | L4 | L3 | L4 | L5 | L3 | L4 | L3 | L4 | L5 | L3 | L4 |
| | | 60A | 150A | 320A | 300A | 750A | 60A | 150A | 320A | 300A | 750A | 60A | 150A | 320A | 300A | 750A |
| 15KPA17A-HR | 15KPA17CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass |
| 15KPA18A-HR | 15KPA18CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass |
| 15KPA20A-HR | 15KPA20CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass |
| 15KPA22A-HR | 15KPA22CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass |
| 15KPA24A-HR | 15KPA24CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | - |
| 15KPA26A-HR | 15KPA26CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | - |
| 15KPA28A-HR | 15KPA28CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | - |
| 15KPA30A-HR | 15KPA30CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | - |
| 15KPA33A-HR | 15KPA33CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | - |
| 15KPA36A-HR | 15KPA36CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | - |
| 15KPA40A-HR | 15KPA40CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | - |
| 15KPA43A-HR | 15KPA43CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | - |
| 15KPA45A-HR | 15KPA45CA-HR | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | pass | - |
| 15KPA48A-HR | 15KPA48CA-HR | pass | pass | pass | pass | - | pass | pass | pass | pass | - | pass | pass | pass | pass | - |
| 15KPA51A-HR | 15KPA51CA-HR | pass | pass | pass | pass | - | pass | pass | pass | pass | - | pass | pass | pass | pass | - |
| 15KPA54A-HR | 15KPA54CA-HR | pass | pass | pass | pass | - | pass | pass | pass | pass | - | pass | pass | pass | pass | - |
| 15KPA58A-HR | 15KPA58CA-HR | pass | pass | pass | pass | - | pass | pass | pass | pass | - | pass | pass | pass | - | - |
| 15KPA60A-HR | 15KPA60CA-HR | pass | pass | pass | pass | - | pass | pass | pass | pass | - | - | pass | pass | pass | - |
| 15KPA64A-HR | 15KPA64CA-HR | pass | pass | pass | pass | - | pass | pass | pass | pass | - | - | pass | pass | pass | - |
| 15KPA70A-HR | 15KPA70CA-HR | pass | pass | pass | pass | - | pass | pass | pass | pass | - | - | pass | pass | pass | - |
| 15KPA75A-HR | 15KPA75CA-HR | pass | pass | pass | pass | - | pass | pass | pass | pass | - | - | pass | pass | pass | - |
| 15KPA78A-HR | 15KPA78CA-HR | pass | pass | pass | pass | - | pass | pass | pass | pass | - | - | pass | pass | pass | - |
| 15KPA85A-HR | 15KPA85CA-HR | pass | pass | pass | pass | - | pass | pass | pass | pass | - | - | pass | pass | pass | - |
| 15KPA90A-HR | 15KPA90CA-HR | pass | pass | pass | pass | - | pass | pass | pass | pass | - | - | pass | pass | pass | - |
| 15KPA100A-HR | 15KPA100CA-HR | pass | pass | pass | - | - | pass | pass | pass | pass | - | - | pass | pass | pass | - |
| 15KPA110A-HR | 15KPA110CA-HR | pass | pass | pass | - | - | pass | pass | pass | pass | - | - | pass | pass | pass | - |
| 15KPA120A-HR | 15KPA120CA-HR | pass | pass | pass | - | - | pass | pass | pass | pass | - | - | pass | pass | pass | - |
| 15KPA130A-HR | 15KPA130CA-HR | pass | pass | pass | - | - | pass | pass | pass | pass | - | - | pass | pass | - | - |
| 15KPA150A-HR | 15KPA150CA-HR | pass | pass | pass | - | - | pass | pass | pass | pass | - | - | pass | pass | - | - |
| 15KPA160A-HR | 15KPA160CA-HR | pass | pass | pass | - | - | pass | pass | pass | pass | - | - | pass | pass | - | - |
| 15KPA170A-HR | 15KPA170CA-HR | pass | pass | pass | - | - | pass | pass | pass | pass | - | - | pass | pass | - | - |
| 15KPA180A-HR | 15KPA180CA-HR | pass | pass | pass | - | - | pass | pass | pass | pass | - | - | pass | - | - | - |
| 15KPA200A-HR | 15KPA200CA-HR | pass | pass | pass | - | - | pass | pass | pass | pass | - | - | pass | - | - | - |
| 15KPA220A-HR | 15KPA220CA-HR | pass | pass | pass | - | - | pass | pass | pass | pass | - | - | pass | - | - | - |
| 15KPA240A-HR | 15KPA240CA-HR | pass | pass | pass | - | - | pass | pass | pass | pass | - | - | pass | - | - | - |
| 15KPA260A-HR | 15KPA260CA-HR | pass | pass | - | - | - | pass | pass | pass | pass | - | - | pass | - | - | - |
| 15KPA280A-HR | 15KPA280CA-HR | pass | pass | - | - | - | pass | pass | pass | pass | - | - | pass | - | - | - |

Note:

1. L1 = Level1, L2 = Level 2, L3 = Level 3, L4 = Level 4, L5 = Level 5